



Stage 1

That really BUGS me!

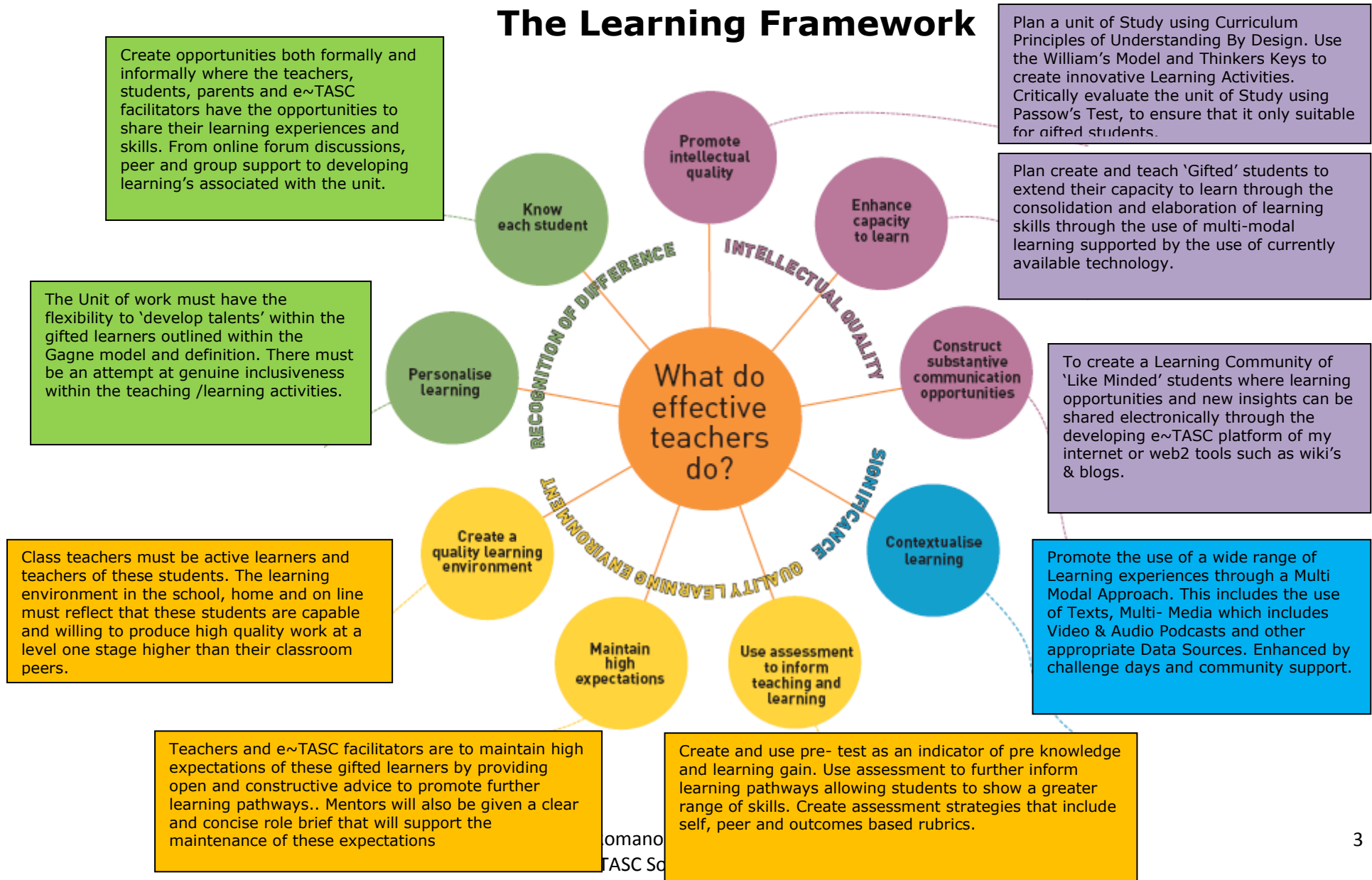


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- e~TASC Stage 1 Unit "That really bugs me!"
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The Learning Framework



Rationale

Unit Focus: Framing scientific inquiry and promoting creative and critical thinking.

Curriculum Principles: Understanding by Design (Wiggins & McTighe) and Williams Taxonomy

This unit of work has been devised for use with identified 'Gifted Learners' in primary schools. Therefore it is very important to understand that the teaching and learning activities are projected to students working at 2 years above their peers. For example a student selected for this unit would currently be in Year 1 or 2 Classroom of mixed ability or a gifted class. **The Outcomes and Assessments are therefore taken from Stage 2 of the NSW BOS** this allows for a number of possibilities; if students fulfil the unit work they could be given an 'A' scale grading as they are being assessed beyond their stage.

This e~TASC unit should be seen as 'Differentiation' **NOT as an extra.**

Students selected to take part in this e ~TASC unit should have been identified using at least two of the identification tools as outlined within the **Gifted and Talented CEO K-12 Position Paper.**

Teaching & Learning:

Herman, Passineau, Schimpf & Treur (1991) argue that, before children can develop an ethic of ecological sustainability, they need opportunities to explore, experience and delight in their natural environment with enthusiastic caring adults.

Children ... demonstrate curiosity and enthusiasm, as they investigate similarities, differences, patterns and change in environments that surround them.

Through Williams Taxonomy and Thinkers Keys (ENVIRO key created for this unit) stage 1 students will be engaged in tasks that will provide learning pathways to ensure students begin to understand the importance of conserving biodiversity, especially insects, to our environment .

Students will be practically involved in scientific inquiry modeling scientists in the real world.

Outcomes

Stage 2 Science & Technology The Natural Environment

Students independently implement aspects of scientific investigation, such as observing, questioning, predicting, testing, recording accurate results, analysing data and drawing conclusions. They demonstrate an understanding of a fair test and identify variables. Students select and safely use equipment, computer based technology and other resources throughout the processes of investigation. Students identify structures and functions of living things and how they interact with each other and their environment. They describe how the properties of materials affect their use.

LTS2.3, PSS2.5, INVS2.7, UTS2.9

That really Bugs me!

ENDURING UNDERSTANDING

The Natural Environment is to be treasured by all and for everyone. Conserving the natural environment is a future challenge.

ENDURING KNOWLEDGE

- The importance of conservation and biodiversity for our environment.
- Components and strategies for scientific inquiry.

KEY FOCUS QUESTION

Why are insects an important part of our Environment?

WORKING UNIT

Teacher topic reference material (AppendixA1)

Pre Test (Appendix1)

Teachers please use the tasks as templates only.....tailor the pre test to best suit your students. You may also like to use the ideas as preliminary activities.

Key Terms (Appendix2)

Students may like to create a “magic book”, fact file etc. of key terms

e~TASC Pet (Appendix3)

Please refer to resource sheet for ideas and associated references

e~TASC Competition (Appendix4)

Stage 1 only e~TASC Pet Bug shot and Journal

This can be entered individually or as a group. Students are to create a MUG SHOT of their pet insect and provide a journal in any form they wishdetailing pet habits, findings etc.

e~TASC ENVIRO KEYS (Appendix 5)

ENVIRO KEYS can be teacher/student negotiated tasks or a scope to provide students with choice to further enhance learning's.

Specific thinkers keys will need to be explicitly taught to students who have not worked with them in the past or whose knowledge is inadequate. Pre Test items will help you establish this.

Please be aware that the ENVIRO KEYS have been created and developed for e~TASC and if used elsewhere they should be acknowledged adequately.



Why are insects an important part of our environment?



Williams: Organised Random Search



Explore the wonderful world of insects

http://www.ento.csiro.au/about_insects/for_kids/index.html

http://www.ento.csiro.au/about_insects/index.html



Williams: Fluency

Library Search : List books about insects create a list of fiction and nonfiction sources

Make a selection of your favourite 3 books and write a brief review on each post on your wiki



Add informative words to your ENVIRO Alphabet Key

Enviro

Combination Key

Use the combination key and create a new insect. Name. Label and draw.

Construction Key

Create an insect of your choice using recyclable materials this can be your e~TASC desk pet!

Reverse Listing

List 10 things that insects could never do.


Name 10 places that you will never find insects.

Why are insects an important part of our environment?



What if..... there were no insects?

(Teacher Reference Appendix 6)

 Use a graphic organiser of your choice to demonstrate your thinking.



Williams: Flexibility

Thinking Scientifically: Working with Data

Classify at least 20 Australian insects according to size and or physical characteristics.

<http://www.csiro.au/org/EntomologyResources.html>

<http://www.insects.org/>

Survey your school, family membershave they seen these insects, if so, how often, where. Design your survey questions with your e~TASC teacher.

Analyse your data can you make conclusions about different insects

Create a brochure, pamphlet or multimedia presentation detailing your findings

Teacher Reference: Thinking Scientifically Appendix 7



Question Key

The answer is_____

Write 5 questions for each answer:

- Insects
- Life Cycle
- Environment

Different Use Key

List 5 different uses for a:

- Fly swatter
- beehive
- compost

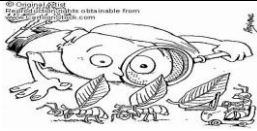
Inventions Key

You need to protect the last remaining Lord Howe Island Phasmid (Dragon Fly)

- a bed sheet
- 2 metres of string
- A squash ball

Why are insects an important part of our environment?

How do scientists help us understand why insects are an important part of our environment?



Real Scientific Research

Scientists in the real world collect data in a variety of ways one of these ways is.....**Quadrant Sampling** (**Appendix 8**)

<http://www.csiro.au/news/MillipedeMayhem.html>

Use a graphic organiser or simple graph to demonstrate your findings.



Williams: Elaboration

[http://education.denniskunkel.com/Wanted-Mugs-](http://education.denniskunkel.com/Wanted-Mugs-Index.php)

[Index.phphttp://www.vickiblackwell.com/insect.html](http://www.vickiblackwell.com/insect.html)

<http://www.garden.org/pestlibrary/bugs.php>

Research Australian Extinct insects create BUG MUGS.....

How can you use your scientific data and researched bug mugs to inform your class mates about extinct insects?

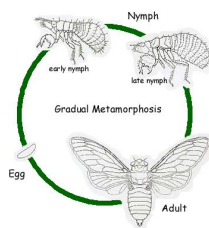


What is a photomicrographer?



Williams: Curiosity

Explore Life Cycle's and create a 3D model displaying the cycle components (use any materials you likerefer to **Appendix 9** for ideas)



Develop a list of questions you would like to ask an entomologist studying the cicada or ----- (your choice)

Why are insects an important part of our environment?

Why is the conservation of Australian Insects important for the future of our environment?



Williams: Complexity

Problems affecting insect conservation

<http://austmus.gov.au/insects/research/conservation.htm>

<http://bugs.bio.usyd.edu.au/Entomology/introduction.html>

<http://www.garden.org/pestlibrary/bugs.php>


Create an advertisement of your choice trying to persuade the community that insects are really not pests.



Williams: Fluency

Case Study analysis

List all the characteristics, advantages/disadvantages that insects have on the environment.

<p>10 species of Australian insects are in great danger of extinction!</p>	<p>Enviro </p>	
<p>Do you like music....?</p> <p>Expand on your mug shots and create 'rap sheets' on your insects.</p>	<p>The Brick Wall Key</p> <p>Insects will eventually be extinct. How are we going to deal with this situation?</p> <p>List some ideas and solutions.</p>	<p>Ridiculous Key</p> <p>Parents should allow every child to house insects in their bedrooms.</p> <p>Write a paragraph which supports this statement.</p>
<p>Variations Key</p> <p>How many ways can insects affect our lives?</p>	<p>The Bar Key</p> <p>Endangered species enclosure.</p> <ul style="list-style-type: none"> • make it bigger • add something to it • Replace something on it <p>Explain your changes and draw a labelled diagram.</p>	<p>Picture Key</p> <p>Use your imagination to work out 10 different things this picture could represent.</p> <p>(Appendix 10)</p>
<p>Alternative Key</p> <p>List 10 environmentally friendly insect repellents.</p>	<p>Prediction Key</p> <p>This is your key.....you create your own question and prediction!</p>	

Please remember to upload your work on your wiki page for other schools to read.

Websites

Environmental websites for kids

<http://edtech.kennesaw.edu/web/insects.html>

http://www.insects.org/ced1/aust_abor.html Aboriginal Perspective

<http://homeschooling.gomilpitas.com/explore/bugs.htm>

<http://www.allaboutnature.com/subjects/insects/printouts.shtml>

http://www.panda.org/news_facts/education/ WWf

<http://www.ento.csiro.au/publicity/pressrel/2001/31oct01.html>

http://www.aussieeducator.org.au/science_insects.html



Appendices

Teacher topic reference material (AppendixA1)

Insects perform important and often vital functions in the environment. We cannot afford to ignore the conservation of insects.

- many ant species are responsible for nutrient cycling and aeration in the soil through tunnel construction and taking organic matter underground
- termites recycle wood and cellulose while many species of flies help recycle decaying organic matter
- most wasps are parasitic and help reduce the numbers of the pest species that they parasitise
- insects are important food sources, not only for other insects, but also for birds, reptiles and mammals
- insects act as pollinators for many species of plants
- insect herbivores help structure vegetation communities
- insects such as pollinators, parasites and predators provide important services to agriculture by increasing production of crops and reducing the impact of pests
- insects help us better understand ecosystem processes and the evolution of the unique Australian biota

Conservation and Biodiversity of Australian Insects

Until recently, most of the broader community conservation interests have ignored the role and importance of terrestrial invertebrates. In Australia insects make up 75% of the known species of animals with the majority of these unique to Australia. Despite this diversity and abundance, many species are known only from a name and a specimen. Our lack of knowledge about insect habitats and ecology is a major barrier to their conservation. Without this knowledge we are unaware if species are threatened with extinction from habitat destruction or other threatening processes. Many insect species may already have been lost without us becoming aware that they existed at all.

Currently 10 species of insects and one population of beetles are listed as endangered under the [NSW Threatened Species Conservation Act, 1995](#).

They include:

- Three butterflies - Bathurst Copper Butterfly *Paralucia spinifera*, Black Grass-dart Butterfly *Ocybadistes knightorum* and Laced Fritillary Butterfly *Argyreus hyperbius*
- Two moths - Golden Sun Moth *Synemon plana* and *Phyllodes imperialis*
- Two beetles - *Nurus atlas* and *Nurus brevis*
- One dragonfly - Giant Dragonfly *Petalura gigantea*
- One stick insect - Lord Howe Island Phasmid *Dryococelus australis*
- One cockroach - Lord Howe Island wood-feeding cockroach *Panesthia lata*

Problems affecting insect conservation planning

Insects are often given a low priority in conservation planning and community support for several reasons. Two major problems are:

- insects do not have the appeal or high profile of some other animals used to promote conservation and the community in general is less aware of their value
- insects in general are perceived by some in the community as pests not worthy of conservation planning

In addition to these two problems, a process known as the 'taxonomic impediment' hampers further research of insects. The taxonomic impediment is the difference between the size of the insect fauna and the resources available to collect describe and document that fauna. Basically, there are not enough scientists working on insect taxonomy to be able to accurately predict which species are threatened or in danger of being lost forever.

Another process known as sampling bias also affects the conservation planning process. All insect taxonomy is based on specimens gathered in the field, or bred from material gathered in the field. Sampling bias occurs when the specimens represented in a collection are from areas that are identical or within close proximity to each other. Typically these are localities close to cities, urban areas, roads, properties, picnic grounds or places where access is relatively easy. Over time the amount of data available for

these sites increases out of proportion to the amount of data available for the entire landmass (eg Australia), leading to sampling bias. Thus for some insect species it cannot be determined if they are rare or endangered, or poorly collected because of sampling bias.

The future of insect conservation

We cannot afford to ignore the conservation of insects as they perform important and often vital functions in the environment. Examples of the important environmental roles insects perform are:

- many ant species are responsible for nutrient cycling and aeration in the soil through tunnel construction and taking organic matter underground
- termites recycle wood and cellulose while many species of flies help recycle decaying organic matter
- most wasps are parasitic and help reduce the numbers of the pest species that they parasitise
- insects are important food sources, not only for other insects, but also for birds, reptiles and mammals
- insects act as pollinators for many species of plants
- insect herbivores help structure vegetation communities
- insects such as pollinators, parasites and predators provide important services to agriculture by increasing production of crops and reducing the impact of pests
- insects help us better understand ecosystem processes and the evolution of the unique Australian biota

The importance and abundance of insects in the landscape means that they are particularly well suited for use as indicators of biodiversity, ecosystem health and landscape degradation. Indeed several different groups of insects have been proposed as indicators of ecosystem health and are used in biodiversity surveys.

At the Australian Museum, since the development of the Centre for Biodiversity and Conservation Research (CBCR), insects have been used extensively in biodiversity surveys. They provide measures of endemism (native to or confined to a certain region), species richness and species abundance in a variety of Australian terrestrial habitats. The research conducted by CBCR has enabled the prediction of areas known as 'hotspots'. These areas are considered to be of exceptional conservation importance.

[© Australian Museum, 2004](#)



http://www.si.edu/Encyclopedia_SI/nmnh/buginfo/start.htm



Information Sheets

- [Beetles](#)
- [Behind the Scenes: Backyard Bugs](#)
- [Behind the Scenes: Drawing Insects](#)
- [Behind the Scenes: Invasive Species](#)
- [Benefits of Insects to Humans](#)
- [Bugs in the News, 2000](#)
- [Bugs in the News, 2001](#)
- [Bugs in the News, 2002](#)
- [Bugs in the News, 2003](#)
- [Butterflies](#)
- [Butterflies in the United States](#)
- [Carpenter Ants](#)
- [Cicada Killer Wasps](#)
- [Diseases Caused by Insects](#)
- [Fun Facts about Bugs](#)
- [Gypsy Moths](#)
- [Household Insect Pests](#)
- [Incredible Insects](#)
- [Insect Flight](#)
- [Insects as Food for Humans](#)
- [Insects as Pets](#)
- [Killer Bees](#)
- [Learning about Insect and Mite Galls](#)
- [Mating in Insects](#)
- [Monarch Butterflies](#)
- [Moths](#)
- [Numbers of Insects \(Species and Individuals\)](#)
- [Pheromones in Insects](#)
- [Science Fair Projects, Suggestions](#)
- [State Insects](#)
- [True Bugs](#)
- [True Flies](#)
- [Wasps, Ants and Bees \(Hymenoptera\)](#)
- [Where Do Insects Go in the Winter](#)

That really Bugs me!

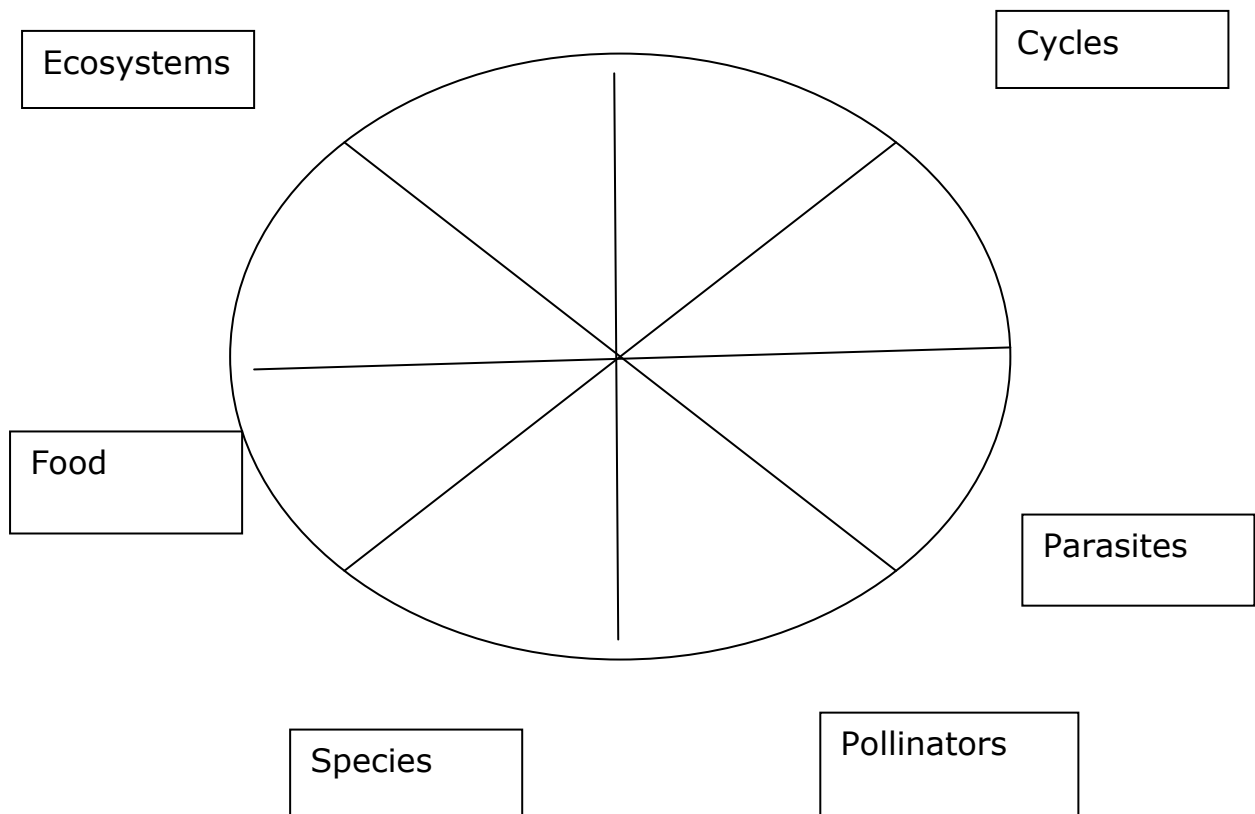
Pre-Test /Preliminary Tasks

Pre Test (Appendix1)

Teachers please use the tasks as templates only.....tailor the pre test to best suit your students. You may also like to use the ideas as preliminary activities.

Why are insects an important part of our environment?

Students complete the format grid with pre knowledge using the words as cues for thought




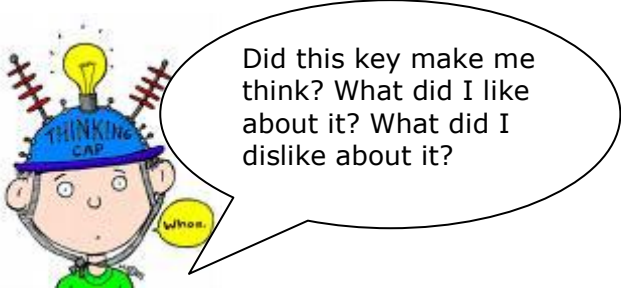


Alphabet

Use letters of the alphabet to describe insects - think about appearance, colours, characteristics, common names, scientific name.- this can be an ongoing list.

A	B	C
D	E	F
G	H	I
J	K	L
M	N	O
P	Q	R
S	T	U
V	W	X
Y	Z	

Have you used thinking keys before?

<p><u>Thinking</u></p> <p><u>Key</u></p> 	<p><u>Comment</u></p> 
<u>Variations</u>	
<u>Alternative</u>	
<u>BAR</u>	
<u>Picture</u>	
<u>Combination</u>	
<u>Construction</u>	
<u>Reverse</u>	
<u>Question</u>	
<u>Different Uses</u>	
<u>Inventions</u>	
<u>Brick wall</u>	
<u>Ridiculous</u>	

Teacher Evaluation

- What information did you gain from the pre-test?
- How did the group dynamics work?
- What strategies were used by students to complete the task?
- Did all students participate?

Key Terms (Appendix2)

Students may like to create a "magic book", fact file etc of key terms

BuGlossary

<http://www.mini-beasts.com/>



e~TASC Pet (Appendix3)

Amateur Entomologist Society

One of the best ways to learn about animals is to keep and look after them. Insects and other invertebrates are no exception. In most cases they are easy to look after (provided you've researched how to care for them first), inexpensive and don't require a vast amount of space. Below are links to care sheets for some of the more commonly kept invertebrates.

Remember: it is important that you know the needs and requirements of your pet before you obtain the animal. You should never, ever obtain an animal before researching its needs and preparing the housing and conditions.

<http://www.amentsoc.org/insects/caresheets/>

Using Insects in the Classroom

By Stephanie Bailey. Adapted from "Six-Legged Science: Insects in the Classroom," by G.A. Dunn.

Updated 10/04 by Blake Newton, Extension Specialist

<http://www.uky.edu/Ag/CritterFiles/casefile/bugconnection/teaching/sixscience.htm>

e~TASC Competition (Appendix4)

Stage 1 only e~TASC Pet

Bug shot and Journal

This can be entered individually or as a school group. Students are to create a BUG SHOT of their pet insect and provide a journal detailing observations and conclusions in any form they wish.

All submissions must be burnt to CD and sent to

Mrs Romano
Christ the King Primary School
2 Cantrell Street,
Yagoona 2199
NSW

Date Due TBA

When competition is closed all entries can be viewed on wiki page

COMPETITION BUG SHOT

There will be an opportunity to ask questions at the challenge day.

e~TASC ENVIRO KEYS (Appendix 5)

Pohl's Thinkers Keys

Combination Key

Lists attributes of two unmatched objects, and then combine them to create a new or better product

Construction Key

Problem solving task requiring creative use of limited quantities of everyday materials

Reverse Key

Place words such as 'cannot', 'never' and 'would not' in sentences which are commonly displayed in a list

Question Key

Start with the answer the list 5 questions that could have that answer only

Different Use Key

Use imagination to list some different uses for a chosen object

Inventions Key

Develop inventions that are constructed in an unusual way or with unusual materials

Brick wall Key

Make a statement which can't usually be disputed, then try to break the wall by finding a way(s) to deal with the situation

Ridiculous Key

Make a ridiculous statement the students have to substantiate it

Variations Key

Find many ways to overcome an obstacle or solve a problem

The Bar Key

Use BAR to improve the design of everyday objects

B= Bigger A=Add R=Remove

Picture Key

A simple picture that has no relevance to the topic is shown. Students try to work out how it is linked to the topic.

Alternative Key

List ways to complete a task without using the normal tools or implements

Prediction Key

Predict possible outcomes to a set of given circumstances or a particular situation

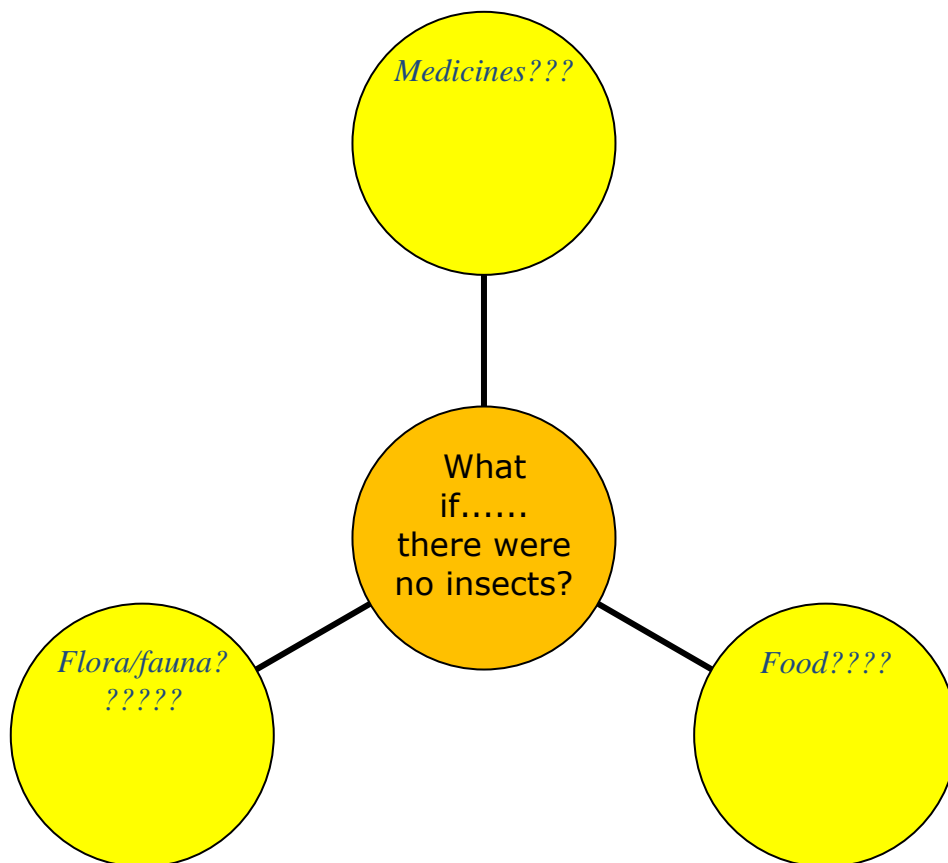
Michael Pohl (2000) Hawker Brownlow Education

Teacher Reference (Appendix 6)



What if..... there were no insects?

Use a graphic organiser of your choice to demonstrate your thinking.



Teacher Reference
Thinking Scientifically (Appendix 7)

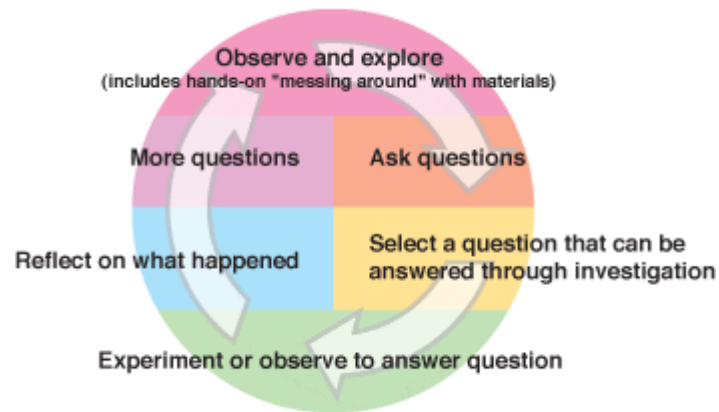


Figure 1.The inquiry process

Reference:

The Southwest Center for Education and the Natural Environment (SCENE)

<http://scene.asu.edu/index.html>

Teacher Reference
Quadrant Sampling (Appendix 8)

http://www.ase.org.uk/practicalprimaryscience/exp_bio_02.html

Biodiversity in your backyard: Fieldwork using your school playing field

Introduction

Introduce the core fieldwork technique of random sampling with quadrats in your school grounds. Random sampling allows you to make an estimate of the populations of different species in any area. It should eliminate sampling bias introduced by the sampler selecting areas that look interesting or easier to count. Develop an understanding of plant biodiversity in the grassland typical of school playing fields. Use the Field Studies Council key *Playing field plants* to identify the species that you find. Students are often surprised by the biodiversity in an area they think of as 'grass'. There is scope for students to develop and investigate hypotheses about plant distribution based on observations and measurements of factors such as soil, moisture, light intensity and wind speed. Observations of human or other animal activity in the area, and background information about the characteristics of common playing field plants, provide further starting points for developing hypotheses to test over short or long time scales.

Lesson organisation

Students working in groups of three (or four) can each take a role in the survey. Depending on your students, it should be possible to carry out your survey of one or two areas of the school grounds in one lesson.

Then, presenting and analysing the results could be completed in the next lesson. Collecting data to investigate hypotheses might be spread over several weeks. Each time the students survey the area, they will be more efficient as they become more familiar with the technique and the species present.

Apparatus and Chemicals

For the class – set up by technician/teacher:

- Tape measure, 20 m, 2 (or string marked into metres)
- Number cards, 1-20, in each of two bags (or bowls or buckets)
- OR 20-sided dice, 2 (ask someone who plays war games or fantasy role-play games)
- Pinboard, or sheet of cardboard (for step 1) with sticky tape or pins to attach plants to the board

For each group of students:

- Quadrat – a wire frame 0.25 m x 0.25 m, or 0.5 m x 0.5 m
- Key to plants – see links
- Clipboard, 1
- Pencil, 1
- Record sheet – devised by teacher or students

Technical notes and safety

1 Choosing your quadrat: A quadrat, not a 'quadrant', is a frame used for sampling an area and it is usually square. Smaller quadrats present a smaller number of species to be identified. However, groups taking 10 samples each with 0.5 m x 0.5 m quadrats will collect information about a more significant sample of the area.

2 Refer to the supplementary risk assessment (SRA 08) dated October 2006 from CLEAPSS for more details of hazards and control measures for working outdoors.

This risk assessment advises that it is important to consider the following.

a How students are likely to behave when working outdoors, and suggests that the normal ratio for classrooms or laboratories may not be adequate to ensure safe working outdoors.

b Provision for hand washing needs to be readily available whenever plants and soil are handled. You might consider the use of alcohol gels or other hand sanitisers with paper towels.

c The low risk of diseases such as toxoplasmosis and toxocariasis from plants and soil contaminated by cat or dog faeces. Covering any cuts and grazes and ensuring that children do not eat snacks or sweets while working outdoors as well as confirming thorough hand washing reduces this risk.

d The possibility of allergic reactions to substances encountered outdoors, such as pollen, plant sap, contact with leaves, insect bites and stings or some hairy caterpillars.

Be alert to the development of any allergic reactions or asthma symptoms and deal with them according to your school's normal policy.

e The risk of sunburn on sunny summer days if exposed for more than 20-30 minutes.

f Risks of injury when using and carrying tools or heavy loads of unfamiliar equipment which should be assessed for each individual in the specific environment.

g Hazards such as building rubble, pot holes in the ground, unsafe structures or items such as broken glass and other 'litter' that could be hidden in grass or soil. Check the area in advance and be aware of any such risks that could cause wounds or cause children to trip and fall. Remove the hazards or identify them with warning signs and keep children away from them.

3 Sample size: You can test whether your sample size is big enough by comparing the results from two groups sampling the same area. If their results are very similar, your sample size is big enough to be a good estimate of the populations in the area.

Ethical issues

It is useful to consider how the act of surveying the area and collecting plants might damage or change the environment surveyed. Although this is probably not an issue for a school playing field (which is regularly mowed and trampled in normal use), it would certainly be an issue for a natural or 'wild' area.

Procedure

SAFETY: Make a full risk assessment for the outdoor activity and put in place any necessary control measures.

Preparation

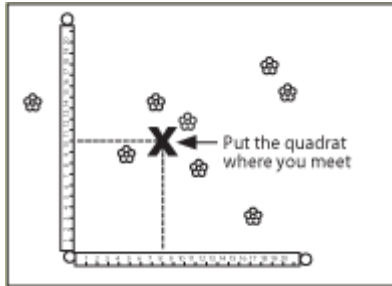
- a** Check the area where you will be working for hazards.
- b** Make a preliminary survey yourself to identify the most common plants (other than grass).
- c** Collect your equipment together and check it for hazards such as sharp edges. Consider attaching tags of brightly-coloured electrical tape to make it easier to locate equipment that gets 'lost' on the site.
- d** Organise your students in groups of three (or four) and identify their roles in the group.

Step 1: Preliminary observations

- a** Stand in the area to be surveyed and make a simple plan drawing of key features – the direction of north, any nearby buildings, large plants (trees and shrubs), favoured paths across the area, slopes etc. Include information about the use of adjacent land and think about whether the site is open and exposed or sheltered by a belt of trees or buildings.
- b** Make a note of any clearly visible features in the 'grassland' vegetation, such as areas of flowering plants, worn grass or darker vegetation.

Step 2: Identifying what species are present

- a** Give the students a quadrat per group. Place the quadrat on the ground and ask students to look closely at the plants and see how many different plants they can see.
- b** Develop vocabulary to describe the differences between plants – for example key botanical features such as leaf veins, sepals, or the arrangement of flower clusters, and the shapes of leaves, the patterns of attachment of leaves to stems, the habit of the plant (ground-hugging, creeping, rosette etc). The table on the inside of the FSC key Playing field plants will guide such observations and allow students to use them to identify the main species of plants.
- c** Collect samples of the five most common plants (other than grass). Write their names on the board and ask each group to bring and attach a sample of each plant to the board.

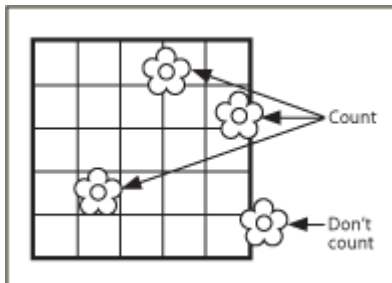


Step 3: Sampling the area – a random sample

a Lay out your tape measures (or marked string) at right angles along two edges of the area to survey. Lay the two bags of numbers near the point where the tapes meet.

b With students working in threes, ask one student to hold the quadrat, a second to pick a number from the bag on one line, the third to pick a number from the other bag on the other line. Then, the students who have numbers should replace the numbers and walk to that number on their line. The student with the quadrat uses their colleagues as place markers and places the quadrat where it is in line with both of them. Then all three can work together to identify the species in their quadrat and record the results.

c Send two students back to the bags on the lines to pick more numbers and randomly select the next quadrat position. Repeat step b.



d Each group should assess the contents of around 10 quadrats to get a reliable estimate of the species distribution.

Step 4: What to record

a In a preliminary investigation, or with younger students, a presence or absence of each species in each quadrat may be enough information.

You can then collate the results to show the percentage of quadrats in which each species was found, which will give you a relative abundance of each species.

b With older students, or to provide data you can analyse with mathematical tools, you will need to estimate and record the number of plants of each species in each quadrat or the percentage cover of each species in each quadrat.

Step 5: Analysing the results

a Use a spreadsheet to analyse the results and produce bar graphs or other plots of the data collected.

b The simplest analysis would be of the percentage of sample quadrats that each species appears in.

c If you have information about frequency (or percentage cover) you can calculate the average frequency (or average percentage cover) of each species for each area sampled.

Teaching notes

It can be very rewarding with younger students simply to open their eyes to the diversity of plant species under their feet. Developing observational skills and learning which features of plants are important when distinguishing one species from another are significant basic skills.

The detail of the data you gather will depend on the investigation you are exploring. A 20 m x 20 m survey area covers 400 m². A 0.25 m quadrat covers one sixteenth of a square metre and a 0.5 m quadrat covers one quarter of a square metre. So, with 10 groups collecting data from 10 quadrats each (100 quadrats surveyed), the group will have sampled 6.25 m² with 0.25 m quadrats (about 1.6% of the area) or 25 m² with 0.5 m quadrats (6.25% of the area). (See note 3.)

A random sample will give you some descriptions that characterise an area. So it is useful if you want to compare two contrasting habitats.

You could make random samples on two different areas of grassland in the school – such as the playing field and any open areas that get less foot traffic, or two different parts of the playing field to see if there are any differences.

It is possible using the method here for selecting your random sample point that two groups of students will survey the same square metre. For introductory exercises this should not pose a problem, but for more thorough investigations you could keep track of the areas sampled and ensure you do not survey any sample square twice.

There are several methods of quantifying biodiversity – apart from comparing a simple list of the number of species identified in each area. One measure is 'species richness'.

Quadrat number	Species present									
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Numbers / percentages in each quadrat										

Others include 'range-size rarity' and 'taxic richness'. See links below, or make a wider internet search.

You could survey to answer questions such as: Are there more daisies in mown or unmown grass? Is there more ribwort plantain where the grass is less trampled?

Alternatively, after identifying differences in distribution of species between two areas, you can start to develop hypotheses that might explain the different distributions.

These might depend on being able to collect further data about the areas.

For example: Is the soil wetter where we find more buttercups?

You could collect and collate information about the plants in the field and maintain a database of distribution information (with photographs) over a number of years.

This kind of random sampling will probably not reveal any trends or changes across an area (such as differences near to or far from a regular walkway where plants are trampled). However, there are systematic sampling techniques that allow you to investigate changes along a line from one part of an area to another – such as a line transect or a belt transect. A good guide to ecological techniques will explain these techniques in more detail.

An example of a simple record sheet that you could use for your field survey is shown.

Some questions to think about:

- 1** What are the 5 main species in each area?
- 2** What do you think are the reasons for any differences?
- 3** How would you investigate these differences further?
- 4** What has surprised you most about the diversity of plants on your school playing field?

Further information

www.field-studies-council.org/publications/pubsinfo.aspx?Code=OP97

Details of the Field Studies Council key to Playing field plants. This will be a great help in identifying the main plants and provides supplementary information about the plants to support hypothesis development and suggestions for further work. (Last accessed November 2008.)

www.field-studies-council.org/outdoorscience/diy.htm

Part of the London Outdoor Science project – with details of how to make and use your own fieldwork equipment. (Last accessed November 2008.)

www.field-studies-council.org/resources/index.aspx

The index to all the Field Studies Council on-line resources. (Last accessed November 2008.)

<http://internet.nhm.ac.uk/eb/homepage.shtml>

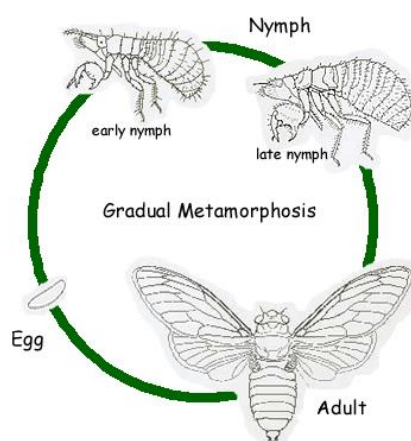
This is the homepage for a project called Exploring biodiversity (dated 2001) on the Natural History Museum (London) website. It includes interactive models that explain how to calculate species richness, range size rarity and taxic richness. You will need to log in using Internet Explorer to view these pages. (Last accessed November 2008.)

Reference:

http://www.ase.org.uk/practicalprimaryscience/exp_bio_02.html

Williams: Curiosity Appendix 9

Explore Life Cycle's and create a 3D model displaying the cycle components (use any materials you likerefer to list for ideas)



- Straws
- Packing peanuts
- Polystyrene
- Bubble wrap
- Corrugated cardboard
- Variety of textured paper
- Natural materials from environment
- Plaster
- Play dough
- Textured fabric
- Textured material e.g.: steelo pads, scourers used for dishwashing
- Straw
- Wire
- Charcoal
- Food
- Twine, string

You may think of other materials.....be sure to add it to your wiki!

Picture Key (Appendix 10)

Use your imagination to work out 10 different things this picture could represent.

